IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

SUPPLEMENTAL APPEAL BRIEF FOR THE APPELLANTS

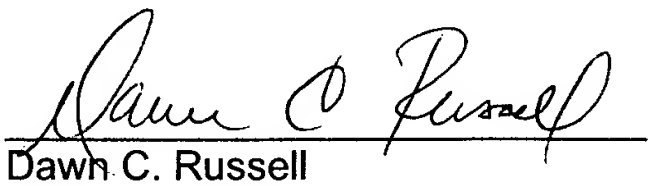
Ex parte MARUYAMA et al.

WAFER AND EPITAXIAL WAFER, AND MANUFACTURING PROCESSES THEREFOR

Serial Number: 09/856,139
Filed: May 29, 2001
Appeal No.:
Group Art Unit: 2814
Examiner: A. Mai

Submitted herewith is a Supplemental Appeal Brief. No fees are believed due in connection with the filing of this paper, however, the Commissioner is hereby authorized to charge any fee deficiencies required with respect to this paper, or overpayment to our Deposit Account No. 01-2300, **referencing docket number 107242-00017.**

Respectfully submitted,



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Date: February 27, 2006

TECH/276477.5

AF

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Fumiaki MARUYAMA et al.

Application No.: 09/856,139

Confirmation No.: 3293

Group Art Unit: 2814

Examiner: A. Mai

Filed: May 29, 2001

Attorney Docket. No.: 107242-00017

For: WAFER AND EPITAXIAL WAFER, AND MANUFACTURING PROCESSES THEREFOR

RESPONSE TO NOTIFICATION OF NON-COMPLIANT APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

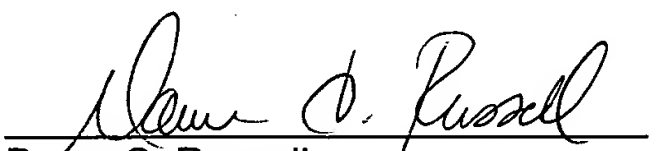
February 27, 2006

Sir:

In response to the Notification of Non-Compliant Appeal Brief mailed February 3, 2006, Appellants are submitting concurrently herewith a Supplemental Appeal Brief in compliance with 37 C.F.R. § 41.37. The Supplemental Appeal Brief is believed to address each of the alleged defects set forth in the Notification.

In the event this paper is not considered to be timely filed, Appellants respectfully petition for an appropriate extension of time. The Commissioner is authorized to charge payment for any additional fees which may be required with respect to this paper or credit any overpayment to Counsel's Deposit Account 01-2300, making reference to Attorney Docket No. 107242-00017.

Respectfully submitted,



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Appellants:

Fumiaki MARUYAMA
Naoki NAITO
Atsuo UCHIYAMA

Confirmation No.: 3293

Group Art Unit: 2814

Application No.: 09/856,139

Examiner: A. Mai

Filed: May 29, 2001

Attorney Docket. No.: 107242-00017

For: WAFER AND EPITAXIAL WAFER, AND MANUFACTURING PROCESSES THEREFOR

SUPPLEMENTAL APPEAL BRIEF

Date: February 27, 2006

This is an appeal from the action of the Examiner dated June 4, 2004, finally rejecting claims 67-77, all of the non-withdrawn claims pending in this application, as being unpatentable over certain prior art under 35 U.S.C. 102 and 35 U.S.C. 103. A Notice of Appeal was timely filed on November 4, 2004, with a Petition for Extension of Time. An Appeal Brief was timely filed on January 4, 2005. A Notice of Non-Compliant Appeal Brief was mailed on February 3, 2006. This Supplemental Appeal Brief is being timely filed.

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I. REAL PARTY IN INTEREST

The real party in interest in present application on appeal is Ulvac Coating Corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences known to the Appellants, Appellants' representative or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-26 have been cancelled, and Claims 27-66 have been withdrawn as directed to a non-elected invention. Claims 67-77, the remainder of the claims pending in the present application, stand rejected and are being appealed.

IV. STATUS OF AMENDMENTS

A Response was timely filed on September 7, 2004. Appellants' Response filed September 7, 2004, did not contain any amendments. Thus, all amendments have been entered by the Examiner for the purposes of appeal.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates to clean room air conditioning facilities comprising: an air conditioner having a boron-less filter and a boron adsorbing filter; and one or more of wafer treatment apparatuses each having a boron-less filter, wherein an atmosphere gas is recycled between the air conditioner, the clean room and the wafer treatment apparatuses, and a method of using thereof.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 67 and 69 stand rejected under 35 U.S.C. 102(e) as being anticipated by Kobayashi et al. (U.S. Patent No. 5,997,598).

Claim 68 stands rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of Johnson (U.S. Patent No. 6,102,977).

Claim 70 stands rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of "Appellant Admitted Prior Art" (referred to hereinafter "AAPA").

Claims 71-77 stand rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of Mitani et al. (U.S. Patent No. 5,804,494) in view of AAPA.

VII. ARGUMENT

A. The Law

1. The law regarding factual inquiries to determine anticipation.

In order to be anticipatory under 35 U.S.C. § 102, a prior art reference must have each and every feature set forth in the claims, Akzo N.V. v. U.S. Int'l Trade Comm'n, 808 F.2d 1471,1 U.S.P.Q. 2d 1241 (Fed. Cir. 1986).

2. The law regarding factual inquiries to determine obviousness.

Several basic factual inquiries must be made to determine obviousness or non-obviousness of patent application claims under 35 U.S.C. § 103. These factual inquiries are set forth in Graham v. John Deere Co., 383 U.S. 1,17,148 U.S.P.Q. 459, 467 (1996):

> Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; the level of ordinary skill in the pertinent art resolved. Against this backdrop, the obviousness or non-obviousness of the subject matter is determined.

The specific factual inquiries set forth in *Graham* have not been considered or properly applied by the Examiner formulating the rejections of claims 4 and 5. Particularly the differences between the prior art and the claims were not properly determined. As stated by the Federal Circuit in In re Ochiai, 37 U.S.P.Q. 2d 1127, 1131 (Fed. Cir. 1995):

> [t]he test of obviousness *vel non* is statutory. It requires that one compare the claim's subject matter as a whole with a prior art to which the subject matter pertains. 35 U.S.C. § 103.

> The inquiry is highly fact-specific by design.... When the references cited by the Examiner fail to establish a *prima facie* case of obviousness, the rejection is improper and will be overturned. In re Fine, 837 F.2d 1071, 1074, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988). (Emphasis added.)

When rejecting claims under 35 U.S.C. § 103, an Examiner bears an initial burden of presenting a prima facie case of obviousness. A prima facie case of obviousness is established only if the teachings of the prior art would have suggested the claimed subject matter to a person of ordinary skill in the art. If an Examiner fails to establish a prima facie case, the rejection is improper and will be overturned. See: In re Rijckaert, 9 F.3d 1531, 28 U.S.P.Q. 2d. 1955 (Fed. Cir. 1993). "If examination.... does not produce a prima facie case of unpatentability, then without more the Appellant is entitled to the grant of the patent." In re Oetiker, 977 F.2d 1443, 1445-1446 24 U.S.P.Q. 2d. 1443, 1444 (Fed. Cir. 1992).

B. The Rejections

Claims 67 and 69 stand rejected under 35 U.S.C. 102(e) as being anticipated by Kobayashi et al. (U.S. Patent No. 5,997,598). Claim 68 stands rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of Johnson (U.S. Patent No. 6,102,977). Claim 70 stands rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of "Appellant Admitted Prior Art" (referred to hereinafter "AAPA"). Claims 71-77 stand rejected under 35 U.S.C. 103(a) as being obvious over Kobayashi et al. in view of Mitani et al. (U.S. Patent No. 5,804,494) in view of AAPA.

1. Appellants claimed invention.

The present claims require, inter alia, "[c]lean room air conditioning facilities comprising an air conditioner having a boron-less filter and a boron adsorbing filter; and one or more wafer treatment apparatuses **each having a boron-less filter**" (see claim 1). The atmosphere gas is recycled between the air conditioner, the clean room and the wafer treatment apparatuses.

2. Rejection of claims 67 and 69 over Kobayashi et al.

Claims 67 and 69 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Kobayashi et al. (U.S. Patent No. 5,997,598). Appellants respectfully submit that the invention defined by present claims 67 and 69 is not anticipated because Kobayashi et al. fails to disclose each and every feature set forth in these claims.

Kobayashi et al. describe an air filter for a clean room. In their Example 3, Kobayashi et al. disclose that "the wall material, the filter material for the air filter (ULPA filter) and the sealing material for securing the filter medium and the frame of the air filter were used in the combination shown in Table 6 to fabricate each of local facilities for use in semiconductor production apparatus" (column 14, lines 55-60).

The Examiner has asserted that Kobayashi et al. teaches "...one or more of wafer treatment apparatuses (local facilities) each having a boron-less filter (ULPA filter)..." However, Table 6 on columns 23 and 24 of the Kobayashi et al. patent makes clear that the boron content of the ULPA filter ("U.F.") material ranges from 15 to 52 μg/g.

As the Examiner has noted, the present specification refers to a boron-less filter as being "an air filter from which no boron is released" (see page 8, line 25 to page 9, line 1 of the present specification. The Office Action then asserts that Kobayashi et al. teaches a boron-less filter since there is no measurable boron in the local facilities described in Kobayashi et al.

However, the boron-containing filters of Kobayashi et al. are not air filters from which no boron is released. Kobayashi et al. disclose that "[a]s can be seen from the results, in the local facilities of Nos. 31 and 33 corresponding to the embodiments of the [Kobayashi et al.] invention, analysis values for the organic phosphorus compounds and the boron compounds in the air at the inside of the local facilities are below the detection limit values, and since the organic phosphorus compounds and the boron compounds are not present in the local facilities, such local facilities are particularly suitable as the local facility for use in semiconductor production. On the contrary, the local facilities of Nos. 32 and 34 corresponding to the comparative examples of the [Kobayashi et al.] invention are not desired, since either the organic phosphorus compounds or the boron compounds are present in the air at the inside of the local facilities and there [is] a worry of causing unnecessary doping for the local facility used in the semiconductor production" (see column 15, line 10 to column 16, line 10).

In fact, the components of the boron-containing filters used in Kobayashi et al. Examples No. 31 and No. 33 appear to be the same as the components used in the boron-containing filters of Kobayashi et al. comparative Examples No. 32 and 34, respectively. As the filters appear to be the same, and as Kobayashi et al. explain that the filters of Examples No. 32 and/or 34 release boron since boron is in the air at the

inside of the local facilities, **the filters of Examples No. 31 and No. 33, being the same as filters 32 and 34, respectively, would also be expected to release boron**.

The present specification characterizes one property of a "boron-less" filter as not releasing boron. The Office Action takes the position that since the filter of Kobayashi et al. does not release boron, the limitation of claim 67 is met. Appellants respectfully disagree that Kobayashi et al. does not release boron.

Appellants wish to explain about a boron-less filter used in the present application (e.g., a boron free ULPA filter (Nippon Muki Co., Ltd. ATMMF-31-P-B); see page 25, the last paragraph of the present specification). As a filter medium, A PTFE (Poly Tetra Fluoro Ethylene) complex material is used for "a boron-less filter" of the present patent application. According to the test result by the manufacturer, boron is not detected from this filter medium. On the other hand, as the comparative example thereof, boron is detected from a filter medium made of glass fibers. Further, at the ultrapure water elution test of the filter medium, boron is not detected from the PTFE complex filter medium while it is detected from the glass filter medium (see the attached English translation of the pamphlet of the manufacturer).

Thus, it is clear that the filter used in Kobayashi et al. contains boron and **releases a small amount of boron** because in Kobayashi et al., the amount of boron content in the PTFE complex filter medium is below detection limit value (see the Examples 24 and 28 of Kobayashi et al.) while boron is detected from the glass filter medium (see the other Examples). Therefore, the boron-releasing filter used in Kobayashi et al. is clearly different from the boron-less filter of the present claims.

"The boron-less filter" used in the present application does not contain boron indeed, but the boron-releasing filter used in Kobayashi et al. is not a boron-less filter. Furthermore, in the present application, the boron concentration in the clean room is 15 ng/m^3 or less (e.g., see page 26 of the present specification). On the other hand, in Kobayashi et al., the boron concentration in the clean room is about 100 ng/m^3, and therefore, the boron concentration in the clean room of Kobayashi et al. is much higher than achieved with the present invention. Accordingly, performance of the filter used in the present application is very different from that of the boron-releasing filter used in Kobayashi et al.

Appellant respectfully submits that the cited prior art fails to teach or suggest the invention of claims 67 and 69, which require "one or more wafer treatment apparatuses each having a boron-less filter." Accordingly, the present invention as claimed is not anticipated, and would not have been obvious to a person of ordinary skill in the art at the time the invention was made in view of Kobayashi et al., taken alone or in any combination with the asserted AAPA and/or Mitani et al. and/or Johnson.

3. Rejection of claim 68 over Kobayashi et al. and Johnson.

Claim 68 stands rejected under 35 U.S.C. § 103(a) as being obvious over Kobayashi et al. in view of Johnson (U.S. Patent No. 6,102,977). Appellants respectfully submit that the Examiner has not made a proper *prima facie* rejection of claim 68 under 35 U.S.C. § 103(a), because the prior art references cited fail to teach or suggest each and every feature set forth in this claim.

The deficiencies of Kobayashi et al. are set forth above in section VII.B.2.

Johnson is applied only to show an outside air handler. As is the case for Kobayashi et al., Johnson does not teach or suggest "one or more wafer treatment apparatuses each having a boron-less filter" as required by the present claims. Johnson thus fails to remedy the deficiencies of Kobayashi et al. with respect to the claimed invention.

Appellant respectfully submits that the cited prior art fails to teach or suggest the invention of claim 68, which requires "one or more wafer treatment apparatuses each having a boron-less filter." Accordingly, the present invention as claimed would not have been obvious to a person of ordinary skill in the art at the time the invention was made in view of Kobayashi et al., taken alone or in any combination with the asserted AAPA and/or Mitani et al. and/or Johnson.

4. Rejection of claim 70 over Kobayashi et al. and AAPA.

Claim 70 stands rejected under 35 U.S.C. § 103(a) as being obvious over Kobayashi et al. in view of "Appellant Admitted Prior Art" (referred to hereinafter "AAPA"). Appellants respectfully submit that the Examiner has not made a proper *prima facie* rejection of claim 70 under 35 U.S.C. § 103(a), because the prior art references cited fail to teach or suggest each and every feature set forth in this claim.

The deficiencies of Kobayashi et al. are set forth above in section VII.B.2.

As is the case for Kobayashi et al., the asserted AAPA does not teach or suggest "one or more wafer treatment apparatuses each having a boron-less filter" as required by the present claims. The asserted AAPA thus fails to remedy the deficiencies of Kobayashi et al. with respect to the claimed invention.

Appellant respectfully submits that the cited prior art fails to teach or suggest the invention of claim 70, which requires "one or more wafer treatment apparatuses each having a boron-less filter." Accordingly, the present invention as claimed would not have been obvious to a person of ordinary skill in the art at the time the invention was made in view of Kobayashi et al., taken alone or in any combination with the asserted AAPA and/or Mitani et al. and/or Johnson.

5. Rejection of claims 71-77 over Kobayashi et al., Mitani et al., and AAPA.

Claims 71-77 stand rejected under 35 U.S.C. § 103(a) as being obvious over Kobayashi et al. in view of Mitani et al. (U.S. Patent No. 5,804,494) in view of AAPA. Appellants respectfully submit that the Examiner has not made a proper *prima facie* rejection of claims 71-77 under 35 U.S.C. § 103(a), because the prior art references cited fail to teach or suggest each and every feature set forth in these claims.

The deficiencies of Kobayashi et al. are set forth above in section VII.B.2.

The deficiencies of the asserted AAPA are set forth above in section VII.B.4.

Mitani et al. is applied only to show the boron concentration in a silicon wafer. As is the case for Kobayashi et al. and the AAPA, Mitani et al. does not teach or suggest "one or more wafer treatment apparatuses each having a boron-less filter" as required by the present claims. Mitani et al. thus fails to remedy the deficiencies of Kobayashi et al. and the asserted AAPA with respect to the claimed invention.

Appellant respectfully submits that the cited prior art fails to teach or suggest the invention of claims 71-77, which require "one or more wafer treatment apparatuses each having a boron-less filter." Accordingly, the present invention as claimed would

not have been obvious to a person of ordinary skill in the art at the time the invention was made in view of Kobayashi et al., taken alone or in any combination with the asserted AAPA and/or Mitani et al. and/or Johnson.

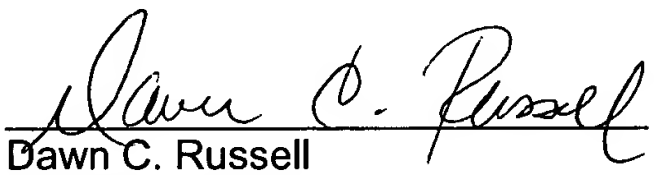
C. Conclusion

For all of the above-noted reasons, it is strongly contended that clear differences exist between the present invention as recited in claims 67-77 and the prior art relied upon by the Office Action.

This final rejection being in error, therefore it is respectfully requested that this Honorable Board of Patent Appeals and Interferences reverse the Examiner's decision in this case and indicate the allowability of claims 67-77.

In the event that this paper is not considered timely filed, Appellants respectfully petition for an appropriate extension of time. Any fees for such extension, together with any additional fees which may be due with respect to this paper, may be charged to Deposit Account No. 01-2300, making reference to attorney docket number 107242-00017.

Respectfully submitted,



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VIII. CLAIMS APPENDIX

Claims 1-26 (Canceled)

27. (Withdrawn) A silicon wafer, characterized in that an attached boron amount on a surface of the silicon wafer is 1×10^{10} atoms/cm^2 or less.

28. (Withdrawn) A silicon wafer, characterized in that an increment of a boron concentration in a surface layer down to a depth of 0.5 μm relative to a boron concentration in bulk silicon direct beneath the surface layer is 1×10^{15} atoms/cm^3 or less.

29. (Withdrawn) A silicon wafer, characterized in that the silicon wafer has a polycrystal silicon layer on one of major surfaces thereof and an increment of a boron concentration in an adjacent layer of a thickness of 1 μm adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the adjacent layer is 1×10^{15} atoms/cm^3 or less.

30. (Withdrawn) A silicon epitaxial wafer, characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in an adjacent layer of a thickness of 1 μm adjacent to and including an interface between

single crystal silicon of the substrate and the polycrystal silicon layer relative to a boron concentration in silicon of the substrate in external contact with the adjacent layer is 1 x 10^{15} atoms/cm^3 or less.

31. (Withdrawn) A silicon wafer, characterized in that the silicon wafer has a structure in which a CVD silicon oxide film is provided on one of major surfaces thereof and an increment of a boron concentration in a single crystal silicon adjacent layer of a thickness within 0.5 μm of an interface between the CVD silicon oxide film and the silicon wafer relative to a boron concentration in bulk silicon in contact with the adjacent layer is 1 x 10^{15} atoms/cm^3 or less.

32. (Withdrawn) A silicon epitaxial wafer, characterized in that the silicon epitaxial wafer has a structure in which a CVD silicon oxide film is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in a substrate single crystal silicon adjacent layer of a thickness within 0.5 μm of an interface between the CVD silicon oxide film and the substrate relative to a boron concentration in silicon of the substrate in contact with the adjacent layer is 1 x 10^{15} atoms/cm^3 or less.

33. (Withdrawn) A silicon wafer according to claim 29, characterized in that the polycrystal layer a boron concentration in at least part of which is 5 x 10^{14} atoms/cm^3 or less is provided on a back surface of the silicon wafer.

34. (Withdrawn) A silicon epitaxial wafer according to claim 30, characterized in that the polycrystal layer a boron concentration in at least part of which is 5×10^{14} atoms/cm^3 or less is provided on a back surface of the single crystal silicon substrate.

35. (Withdrawn) A silicon wafer, characterized in that the silicon wafer has a structure in which a polycrystal silicon layer is provided on one major surface of a single crystal silicon layer and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a first adjacent layer of a thickness of 1 μm adjacent to and including an interface between the polycrystal silicon layer and the single crystal silicon layer relative to a boron concentration in silicon in external contact with the first adjacent layer is 1×10^{15} atoms/cm^3 or less and an increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5 μm adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is 1×10^{15} atoms/cm^3 or less.

36. (Withdrawn) A silicon epitaxial wafer, characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a substrate and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a second adjacent layer of a thickness of 1 μm adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the second adjacent layer is 1×10^{15} atoms/cm^3 or less and an

increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5 μm adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is 1×10^{15} atoms/cm^3 or less.

37. (Withdrawn) A silicon wafer according to claim 27, characterized in that a boron concentration in the single crystal silicon bulk is 1×10^{16} atoms/cm^3 or less.

38. (Withdrawn) A silicon wafer according to claim 28, characterized in that a boron concentration in the single crystal silicon bulk is 1×10^{16} atoms/cm^3 or less.

39. (Withdrawn) A silicon wafer according to claim 29, characterized in that a boron concentration in the single crystal silicon bulk is 1×10^{16} atoms/cm^3 or less.

40. (Withdrawn) A silicon wafer according to claim 31, characterized in that a boron concentration in the single crystal silicon bulk is 1×10^{16} atoms/cm^3 or less.

41. (Withdrawn) A silicon wafer according to claim 35, characterized in that a boron concentration in the single crystal silicon bulk is 1×10^{16} atoms/cm^3 or less.

42. (Withdrawn) A silicon epitaxial wafer according to claim 30, characterized in that a boron concentration in the substrate is 1×10^{16} atoms/cm^3 or less.

43. (Withdrawn) A silicon epitaxial wafer according to claim 32, characterized in that a boron concentration in the substrate is 1 x 10^{16} atoms/cm^3 or less.

44. (Withdrawn) A silicon epitaxial wafer according to claim 36, characterized in that a boron concentration in the substrate is 1 x 10^{16} atoms/cm^3 or less.

45. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 27, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

46. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 28, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

47. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 29, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

48. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 31, the silicon wafer is

subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

49. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, the silicon wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

50. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 30, the silicon epitaxial wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

51. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 32, the silicon epitaxial wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

52. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 36, the silicon epitaxial wafer is subjected to handling such as treatment and storage in an atmosphere of a boron concentration of 15 ng/m^3 or less.

53. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 29, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

54. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

55. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 30, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

56. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 36, formation of a polycrystal silicon layer is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

57. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 31, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

58. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

59. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 30, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

60. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that in manufacture of the silicon epitaxial wafer according to claim 36, formation of a CVD silicon oxide film is performed in an atmosphere of a boron concentration of 15 ng/m^3 or less.

61. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 29, a polycrystal layer is formed on a surface on which an attached boron amount is suppressed to 1 x 10^{10} atoms/cm^2 or less.

62. (Withdrawn) A manufacturing process for a silicon wafer, characterized in that in manufacture of the silicon wafer according to claim 35, a polycrystal layer is

formed on a surface on which an attached boron amount is suppressed to 1 x 10^{10} atoms/cm^2 or less.

63. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that the manufacture of the silicon epitaxial wafer according to claim 30, a polycrystal layer is formed on a surface on which an attached boron amount is suppressed to 1 x 10^{10} atoms/cm^2 or less.

64. (Withdrawn) A manufacturing process for a silicon epitaxial wafer, characterized in that the manufacture of the silicon epitaxial wafer according to claim 36, a polycrystal layer is formed on a surface on which an attached boron amount is suppressed to 1 x 10^{10} atoms/cm^2 or less.

65. (Withdrawn) An atmosphere control apparatus, characterized in that the atmosphere control apparatus controls a boron concentration in an atmosphere to be 15 ng/m^3 or less.

66. (Withdrawn) A clean room, characterized in that a boron concentration in an atmosphere of the clean room is 15 ng/m^3 or less.

67. (Original) Clean room air conditioning facilities comprising: an air conditioner having a boron-less filter and a boron adsorbing filter; and one or more of wafer treatment apparatuses each having a boron-less filter, wherein an atmosphere

gas is recycled between the air conditioner, the clean room and the wafer treatment apparatuses.

68. (Previously Presented) Clean room air conditioning facilities according to claim 67, further including an outdoor air cleaner having a boron-less filter and a boron adsorbing filter.

69. (Original) Clean room air conditioning facilities according to claim 67, in which an internal pressure of a wafer treatment apparatus is adjusted to be higher than a clean room internal pressure and the clean room internal pressure is adjusted to be higher than an external pressure.

70. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that an attached boron amount on a surface of the silicon wafer is 1×10^{10} atoms/cm^2 or less.

71. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that an increment of a boron concentration in a surface layer down to a depth of 0.5 μm relative to a boron concentration in bulk silicon direct beneath the surface layer is 1×10^{15} atoms/cm^3 or less.

72. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon wafer has a polycrystal silicon layer on one of major surfaces thereof and an increment of a boron concentration in an adjacent layer of a thickness of 1 μm adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the adjacent layer is 1×10^{15} atoms/cm^3 or less.

73. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in an adjacent layer of a thickness of 1 μm adjacent to and including an interface between single crystal silicon of the substrate and the polycrystal silicon layer relative to a boron concentration in silicon of the substrate in external contact with the adjacent layer is 1×10^{15} atoms/cm^3 or less.

74. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon wafer has a

structure in which a CVD silicon oxide film is provided on one of major surfaces thereof and an increment of a boron concentration in a single crystal silicon adjacent layer of a thickness within 0.5 μm of an interface between the CVD silicon oxide film and the silicon wafer relative to a boron concentration in bulk silicon in contact with the adjacent layer is 1×10^{15} atoms/cm^3 or less.

75. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon epitaxial wafer has a structure in which a CVD silicon oxide film is provided on a back surface of a single crystal silicon substrate and an increment of a boron concentration in a substrate single crystal silicon adjacent layer of a thickness within 0.5 μm of an interface between the CVD silicon oxide film and the substrate relative to a boron concentration in silicon of the substrate in contact with the adjacent layer is 1×10^{15} atoms/cm^3 or less.

76. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon wafer has a structure in which a polycrystal silicon layer is provided on one major surface of a single crystal silicon layer and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a first adjacent layer of a thickness of 1 μm adjacent to and including an interface between the polycrystal silicon layer and the single crystal silicon layer relative to a boron concentration in silicon in

external contact with the first adjacent layer is 1 x 10^{15} atoms/cm^3 or less and an increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5 μm adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is 1 x 10^{15} atoms/cm^3 or less.

77. (Original) A manufacturing process for a wafer, characterized in that manufacture of the wafer is performed using clean room air conditioning facilities according to claim 67, the wafer being characterized in that the silicon epitaxial wafer has a structure in which a polycrystal silicon layer is provided on a back surface of a substrate and a CVD silicon oxide film is further provided on the polycrystal silicon layer, and an increment of a boron concentration in a second adjacent layer of a thickness of 1 μm adjacent to and including an interface between the polycrystal silicon layer and a single crystal silicon layer relative to a boron concentration in silicon in external contact with the second adjacent layer is 1 x 10^{15} atoms/cm^3 or less and an increment of a boron concentration in a polycrystal silicon adjacent layer of a thickness of 0.5 μm adjacent to and including an interface between the CVD silicon oxide film and the polycrystal silicon layer relative to a boron concentration in polycrystal silicon in external contact with the polycrystal silicon adjacent layer is 1 x 10^{15} atoms/cm^3 or less.

IX. EVIDENCE APPENDIX

The attached Japanese-language pamphlet and English translation describe the boron-free ULPA filter described in Appellants' specification (Nippon Muki Co., Ltd. ATMMF-31-P-B). The Japanese-language pamphlet and English translation were submitted with the Response under 37 C.F.R. § 1.116 that was filed on September 7, 2004. In the Advisory Action dated September 30, 2004, the Examiner indicated that the response had been considered, but did not place the application in condition for allowance.

The Japanese-language pamphlet and English translation are referred to above in Section VII.B.2, on page 11.

ろ材の金属成分分析

1．目的

(1)ろ材に含まれる金属元素の種類と量を確認しました。

(2)半導体製造工程で問題となっているB、Pといった金属元素が発生していないことを確認しました。

(3)GC－MSでは、検出しない微量金属の定性・定量を行い発生する可能性のある元素を確認しました。

2．試験方法

試験体を細かく粉砕した後、硫酸及び硝酸により分解した液をＩＣＰ発光分光法により定性分析(Ｌｉ～Ｂｉ)及び半定量分析をしました。ＰＴＦＥ複合膜ろ材は全分解しましたが、ガラスろ材は、全分解していないため溶出分のみの値となっています。

3．結果

定性・半定量分析により検出された元素について表１にまとめました。

表１　ろ材に含まれる金属元素（測定の一例）

単位：μｇ／ｇ

No.	検出元素名	検出限界	ＰＴＦＥ複合膜ろ材	ガラスろ材
1	Ｂ　(ホウ素)	20	ＮＤ	1～10%
2	Ｐ　(リン)	200	ＮＤ	ＮＤ
3	Ｓｉ(ケイ素)	100	ＮＤ	主成分
4	Ｎａ(ナトリウム)	10	ＮＤ	1～10%
5	Ｋ　(カリウム)	20	ＮＤ	1,000～10,000
6	Ａℓ (アルミニウム)	20	ＮＤ	1,000～10,000
7	Ｂａ(バリウム)	10	ＮＤ	ＮＤ
8	Ｃａ(カルシウム)	2	ＮＤ	1,000～10,000
9	Ｆｅ(鉄)	10	ＮＤ	10～100
10	Ｍｇ(マグネシウム)	10	ＮＤ	10～100
11	Ｓｂ(アンチモン)	100	100～1,000	ＮＤ
12	Ｓｒ(ストロンチウム)	2	ＮＤ	10～100
13	Ｔｉ(チタン)	10	1,000～10,000	10～100
14	Ｚｎ(亜鉛)	10	ＮＤ	100～1,000

注）ＮＤ：検出限界以下

4．考察

(1)ＰＴＦＥ複合膜ろ材からは半導体製造工程で問題となるＢ、Ｐ、Ｓｉと云った無機系の元素は、検出されませんでした。よって、ＰＴＦＥ複合膜ろ材は、これらの元素を含有していません。

(2)ＰＴＦＥ複合膜ろ材の含有金属元素量は、ガラスに比べ非常に少なくなっています。

以上

ろ材の超純水溶出試験

1．目的

半導体・液晶等の分野のクリーンルームにおいて、各種部材から発生する微量ガスによる汚染が問題となっています。特にガラス繊維ろ材を用いたフィルタからの発生するボロンや、各種樹脂から発生する揮発性有機物質は問題となっています。

そこで、ボロンフリーフィルタのろ材の超純水中への溶出試験を行い、溶出金属成分量を確認しました。

2．試験方法

200×200mmのＰＴＦＥ複合膜とガラスろ材を80mℓの超純水中に３日間浸漬し、溶出した金属成分をＩＣＰ－ＭＳで測定しました。

3．結果

測定により検出された元素について表１にまとめました。

表１　ろ材からの溶出金属量

単位：ｎｇ／mℓ(ppb)

No.	検出元素名	ＰＴＦＥ複合膜	ガラスろ材
		測定値	測定値
1	Ｎａ(ナトリウム)	20	6000
2	Ｋ　(カリウム)	13	1000
3	Ｍｇ(マグネシウム)	1	70
4	Ｃａ(カルシウム)	20	500
5	Ｓｒ(ストロンチウム)	ＮＤ	7
6	Ｂａ(バリウム)	ＮＤ	80
7	Ｔｉ(チタン)	ＮＤ	0.3
8	Ｆｅ(鉄)	3	8
9	Ｚｎ(亜鉛)	2	30
10	Ｂ　(ボウ素)	ＮＤ	2000
11	Ａℓ(アルミニウム)	ＮＤ	20
12	Ｓｂ(アンチモン)	ＮＤ	0.3

注：ＮＤ：検出限界以下

4．考察

(1)ＰＴＦＥ複合膜ろ材の溶出液からは、半導体・液晶等製造工程で問題となるＢ、Ｐ、Ｓｉと云った金属元素は、検出されませんでした。

以上

Analysis of the metallic ingredient of filter medium

I. Purpose

(1) Checking types and amounts of the metallic elements contained in filter medium.

(2) Checking the metallic elements that become a subject of discussion in the process of manufacturing a semiconductor, such as Boron, Phosphorus, do not generate.

(3) Checking the possible elements that may be generated, by means of the qualitative analysis and the quantitative analysis of the small amount of elements that cannot be detected by GC-MS (Gas Chromatography Mass Spectrometer).

II. Testing method

After crushing a test sample into the fragments and resolving the fragments by sulfuric acid and nitric acid, the qualitative analysis and the quantitative analysis of elute was carried out by means of ICP-OES (Inductively Coupled Plasma Optical Emission Spectroscopy). A PTFE (Poly Tetra Fluoro Ethylene) complex film filter medium was fully resolved, but numerical values of a glass filter medium were only for elution because the glass filter medium was not fully resolved.

III. Result

Elements detected by the qualitative analysis and the quantitative analysis were shown in Table 1.

Table 1: The metallic elements contained in the filter medium (an example of measurement)

Unit: μg/g

No.	Name of detected element	Detection limit	PTFE complex film filter medium	Glass filter medium
1	B (boron)	20	ND	1-10 %
2	P (phosphorus)	200	ND	ND
3	Si (silicon)	100	ND	the main

				component
4	Na (sodium)	10	ND	1-10 %
5	K (kalium)	20	ND	1,000-10,000
6	Al (aluminium)	20	ND	1,000-10,000
7	Ba (barium)	10	ND	ND
8	Ca (calcium)	2	ND	1,000-10,000
9	Fe (iron)	10	ND	10-100
10	Mg (magnesium)	10	ND	10-100
11	Sb (antimon)	100	100-1,000	ND
12	Sr (strontium)	2	ND	10-100
13	Ti (titanium)	10	1,000-10,000	10-100
14	Zn (zinc)	10	ND	100-1,000

* ND (Not Detected) : below detection limit value

VI. Observations

(1) The metallic elements that become a subject of discussion in the process of manufacturing a semiconductor, such as Boron, Phosphorus, did not generate from the PTFE complex film filter medium. Thus, the PTFE complex film filter medium does not contain the above elements.

(2) The metallic elements contained in the PTFE complex film filter medium is much less than that contained in the glass filter medium.

Ultrapure water elution test of filter medium

I. Purpose

(1) In a clean room used in the technical field of semiconductor or liquid crystal, contamination from each of the members provided in the clean room by the small amount of gas is a problem. Specifically, boron, which is generated from a filter medium of glass fiber, or volatile organic material, which is generated from a variety of resins, is the problem.

Accordingly, I checked the amount of metallic content eluted into ultrapure water by carrying out an elution test into ultrapure water of a filter medium used in the boron-free filter.

II. Testing method

After immersing a PTFE complex film filter medium (200 x 200 mm) and a glass filter medium (200 x 200 mm) into ultrapure water (80 ml) for three days, eluted metallic content was measured by ICP-MS (Inductively Coupled Plasma Mass Spectrometry).

III. Result

Elements detected by the measurement were shown in Table 1.

Table 1: The amount of eluted metallic content from the filter medium

Unit: ng/ml (ppb)

No.	Name of detected element	PTFE complex film filter medium	Glass filter medium
		Measured value	Measured value
1	Na (sodium)	20	6000
2	K (kalium)	13	1000
3	Mg (magnesium)	1	70
4	Ca (calcium)	20	500
5	Sr (strontium)	ND	7
6	Ba (barium)	ND	80
7	Ti (titanium)	ND	0.3
8	Fe (iron)	3	8
9	Zn (zinc)	2	80
10	B (boron)	ND	2000
11	Al (aluminium)	ND	20
12	Sb (antimon)	ND	0.3

* ND (Not Detected) : below detection limit value

VI. Observations

(1) The metallic elements that become a subject of discussion in the process of manufacturing a semiconductor, such as Boron, Phosphorus, silicon did not generate from the elute.

X. RELATED PROCEEDINGS APPENDIX

None.